Turbulent Reduction of Drifts for Solar Energetic Particles

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Particle drifts perpendicular to the background magnetic field were proposed in the past as an explanation for the very efficient perpendicular transport of solar energetic particles (SEPs). This process, however, competes with cross-field diffusion caused by magnetic turbulence, which will also disrupt the drift patterns and reduce the efficiency of drift effects. We present a first theoretical step for a theory of drift suppression in SEP transport by deriving the turbulence-dependent drift reduction function with a pitch-angle dependence and by investigating to what extent drifts will be reduced in the inner heliosphere for realistic turbulence conditions and different pitch-angle dependencies of the perpendicular diffusion coefficient. We find that cross-field diffusion will have the largest influence on the perpendicular transport of 100 MeV solar energetic protons, as opposed to particle drifts, and we discuss how particle streaming along the background magnetic field can also be inhibited, due to particles streaming along perturbed field lines, to cause delayed onsets at an observer.